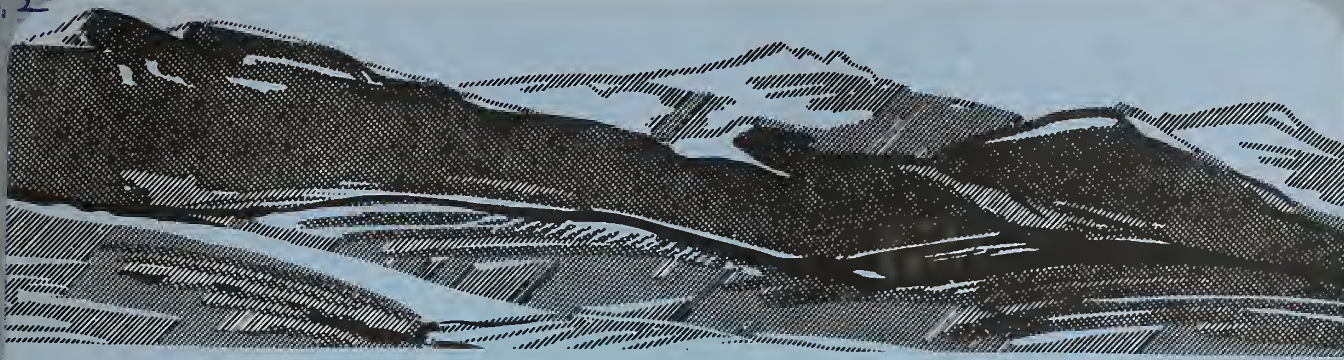

RANGE IMPROVEMENT NOTES

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INDEX

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STATEMENT OF PUBLICATION

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This publication is printed primarily to inform professional range administrators of important range improvement and management developments and findings. These "NOTES" may include extracts of published papers, unpublished preliminary reports of research work, unpublished reports on administrative studies and personal observations or suggestions of other range administrators. No claim is made as to the accuracy or completeness of studies or conclusions drawn.

All who read these RANGE IMPROVEMENT NOTES are encouraged to submit material for publication, or suggestions for improving its usefulness. Full credit will be given for any material used.

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A SIMPLIFIED CHEMICAL METHOD FOR SAGEBRUSH IDENTIFICATION

By

A. H. Winward and E. W. Tisdale[1]

Taxonomic recognition of additional kinds of woody sagebrush (Artemisia) in recent years has re-emphasized that this is a difficult group to identify. People working with rangelands, whether as administrators, technical advisors, or researchers have come to realize the importance of correct identification in this group. This means recognition at species and often subspecies level, and here lie the difficulties.

This report presents a simple and rapid method to aid in making some of the more difficult separations in the sagebrush complex. It was developed during a study of the ecology and taxonomy of mountain big sagebrush (*Artemisia tridentata* subsp. *vaseyana*).[2] Both thin-layer chromatography and morphological characters are being used in this investigation. During the course of the research we found that the general fluorescent color of a sample of *Artemisia* foliage under ultraviolet light could be helpful in separating certain groups. Young (1965) used this method for initial separation of *Artemisia* samples, followed by chromatographic tests for detailed information. The fluorescent extract method has been tested further by the authors, and is presented here as a field aid for identification of difficult species and/or subspecies in *Artemisia*. Although this is designed for use with fresh leaf material, it works equally well with dried leaves from the field or from herbarium specimens. The method involves placing a few grams of sagebrush leaves into a clear glass bottle. Add enough methanol or ethanol to just cover the leaves. Allow the alcohol to react approximately one-half hour (addition of 5 percent HCl to the alcohol or heat from direct sunlight will reduce the reaction time by one-half). In a darkened area, hold a long wave ultra-violet lamp (3660 angstroms) over the bottle and observe the fluorescent color of the leaf extract directly through the glass bottle. This may be done in the field by using a battery powerpack or after returning to an area where electricity is available. Two general groups may be observed: (1) those that fluoresce shades of bluish-cream and (2) those that fluoresce shades of brownish-red.

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[1] N.D.E.A. Fellow and Professor of Range Management, respectively.

[2] Assistance from the Intermountain Forest and Range Experiment Station of the U. S. Forest Service, and funds provided under the National Defense Education Act are gratefully acknowledged.

Group 1.

<u>Fluoresce shades of bluish-cream</u>

A. tridentata subsp. *vaseyana* (mountain big sagebrush)

A. rothrockii (rothrock sagebrush)

A. cana subsp. *bolanderi* (bolander silver sagebrush)

A. arbuscula subsp. *arbuscula* (low sagebrush)

A. arbuscula subsp. *thermopola* (hotsprings sagebrush)

A. longiloba (alkali sagebrush)

A. tripartita subsp. *tripartita* (three-tip sagebrush)

A. bigelovii (bigelow sagebrush)

Group 2.

<u>Fluoresce shades of brownish-red</u>

A. tridentata subsp. *tridentata* (basin big sagebrush)

A. tridentata subsp. *wyomingensis* (Wyoming big sagebrush)

A. nova (black sagebrush)

A. tripartita subsp. *rupicola* (Wyoming three-tip sagebrush)

A. cana subsp. *cana* (silver sagebrush)

A. rigida (scabland sagebrush)

Greater difficulties are encountered in morphologically separating taxa of these two groups than taxa within either group. Examples of the use of this fluorescent technique are provided below. The nomenclature follows Beetle's (1960) classification. Other studies by Young (1965), Holbo and Mozingo (1965) and work at the University of Idaho substantiate to a large degree the taxinomic separations outlined by Beetle.

Suppose one wishes to know whether the dwarf sagebrush of an area is A. nova or A. arbuscula. Within A. nova are two color variants. One has dark green leaves and the other is a more pubescent and therefore gray colored form. The green form is distinct and more easily recognized while the gray form more closely resembles A. arbuscula and is easily confused with it. These species are easily separated by the fluorescent method. When treated with alcohol both forms of A. nova fluoresce a brownish-red color while both subspecies of A. arbuscula fluoresce a bluish-cream color.

This technique also is valuable in separating subspecies within the big sagebrush group. A. tridentata subsp. vaseyana fluoresces bluish-cream while the subspecies tridentata and wyomingensis fluoresce brownish-red. Fortunately, it appears that the newly recognized subspecies wyomingensis can be distinguished from the subspecies tridentata by morphological characters, for the fluorexcence test will not separate these two.

For plants lacking flower shoots, some difficulty may be encountered in separating young plants of big sagebrush from those of the dwarf species. The fluorescence test will be valuable here. Artemisia tridentata subsp. wyomingensis and subsp. tridentata can be separated from A. arbuscula and as skill is acquired with this method, it will be possible to separate subspecies vaseyana and A. arbuscula (though both are in the bluish-cream group) by the shade of bluish-cream fluorescence.

Other species such as A. tripartita, A. cana, A. rigida, A. rothrockii and A. bigelovii are readily identified by their morphological characteristics and/or geographic location. Although usable, the fluorescence test is not usually necessary to separate these species.

After identifying the more difficult sagebrush species and subspecies several times with the fluorescence test, one should be able to separate them by their subtle morphological characteristics alone and the test will be necessary only as an occasional check.

Research at this University suggests that accurate separation of sagebrush species and subspecies has more than taxonomic value. In addition to distinctive morphological and chemical differences, each taxon has its own ecological requirements and associated species. These are important considerations for management of the vegetation types involved. Differences are also being found in behavior and palatability among some of these species. Future study should provide more information on these differences as well as additional taxonomic data.

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We no longer have three R's in this country.

Instead, we have six R's - -

Remedial Reading, Remedial 'Riting,

and Remedial 'Rithmetic.

Robert M. Hutchins

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Love and a cough cannot be hid.

George Herbert

WHEATGRASS ESTABLISHMENT WITH TILLAGE AND HERBICIDES IN A MESIC MEDUSAHEAD COMMUNITY[1]

By

James A. Young, Raymond A. Evans, and Richard E. Eckhert, Jr., Range Scientists, Crops Research Division, Agriculture Research Service, U.S.D.A. - Reno, Nevada

Highlight

Intermediate wheatgrass seedlings were successfully established in a medusahead community in 1965, 1966, and 1967 with mechanical or chemical fallow treatments. Summer fallowing by disk harrowing was the most successful treatment. The most productive wheatgrass stands suppressed but did not eliminate medusahead.

* * * * *

Medusahead (*Taeniatherum asperum* (Sim.) Nevski) poses a difficult problem for ranchers and resource managers in California, Idaho, Nevada, Oregon and Washington. When this winter annual grass becomes established on depleted ranges, forage productivity is drastically reduced (Torell et al., 1961;.Turner et al, 1963). Grazing capacity on some ranches has been decreased as much as 75 percent (Major et al., 1960).

The ultimate control of medusahead over the millions of acres of rangeland that it now occupies is basically a matter of suppression by well managed perennial grasses (Torell, 1967). By the time medusahead becomes established and occupies extensive areas in a rangeland community, the perennial grass component of the community is too depleted to respond to management. In these situations the need for range seeding is imperative.

The extreme competition offered by dense medusahead stands makes weed control essential for establishment of perennial grass seedlings. Kay and McKell (1963) used several pre-emergence herbicides to aid in establishment of rose clover (*Trifolium hirtum* All.) and hardinggrass (*Phalaris tuberosa* L. var. *stenoptera* (Hack.) in medusahead stands. The most widely tested herbicide for medusahead control is 2,4-dichloropropionic acid (dalapon). This herbicide has successfully controlled

[1] Permission granted by James A. Young for reprint from Journal of Range Management, Vol. 22, No. 3, May 1969.

medusahead in California, Idaho, and Oregon (Kay, 1963; Turner et al., 1963; Torell, 1967). On the California annual range, control of medusahead with low rates of 1, 1'-dimethyl-4, 4'-bipyridinium salts (paraquat) has been extremely effective in the establishment of hardinggrass and annual clovers (Kay, 1966).

Our objectives in this study were: (1) to evaluate tillage and herbicide treatments for control of medusahead; (2) to determine the most effective method for establishment of perennial grasses in conjunction with medusahead control; and (3) to ascertain the best adapted perennial grass species for seeding on the medusahead site being investigated.

METHODS

We conducted this investigation at Verdi, Nevada (11 miles west of Reno at the base of the Sierra Nevada Mountains). The medusahead infestation is found on a formerly cultivated, unimproved pasture. The experimental plots were established on a long 5 percent slope facing east to southeast. Soil moisture increases along a gradient beginning with dry rangeland at the upper end and ending in a wet meadow at the lower. The upper portion of the slope is occupied almost entirely by medusahead. Small areas disturbed by rodents or grazing animals supported sparse stands of downy brome (*Bromus tectorum* L.) and hairy chess (*B. commutatus* Schrad.). Growing intermixed with, but suppressed by the medusahead population, were scattered plants of field bindweed (*Convolvulus arvensis* L.) and poverty weed (*Iva axillaris* Pursh.). The only remaining perennial grasses on the upper portion of the site were scattered bunches of squirreltail (*Sitanion hystrix* (Nutt.) J. G. Smith) and isolated rhizomatous clumps of streambank wheatgrass (*Agropyron riparium* Scribn. and Smith). The more mesic lower slope supported a thick stand of medusahead around dense clumps of Baltic rush (*Juncus balticus* Willd.). A thin remnant stand of pine bluegrass (*Poa scabrella* (Thurb.) Benth.) and meadow barley (*Hordeum brachyantherum* Nevski) was interspersed in the medusahead.

Precipitation amounts and distribution were extremely variable during the investigation. In 1963-64 (July-June) 13.4 inches of precipitation were received. The 1964-65 precipitation was 12.8 inches. In 1965-66 virtually no precipitation fell after January and the total was 7.3 inches. The winter and spring of 1966-67 were extremely wet with 33 inches of precipitation recorded. Reno, Nevada, has a long-time average annual

precipitation of 7.73 inches, while at Truckee, California, 25 miles west of Verdi and higher in the mountains, the annual precipitation averages over 30 inches (U.S.D.A., 1941).

The soils of the Verdi plots are members of a loamy-skeletal, mixed, mesic family of Typic Haplaquolls. They have developed in gravelly alluvium from andesite, tuffs, and tuff breccias.

Design of all field trials involving logarithmic spraying of herbicides was a four-replicated split plot with systematic arrangement of subplots (rates) (Cochran & Cox, 1950).

We visually evaluated weed control through the growing season on all plots. Oven-dry yields of the mature weeds were used to evaluate season-long control.

We evaluated stand establishment of perennial grasses by 1st-year seedling counts and height measurements made in late July after annual plants had died. In 1964, perennial grass seedlings were counted several times during the growing season, to study time of stress and mortality of seedlings.

To further evaluate stand establishment, vigor, and productivity, we clipped perennial grasses for yield in successive years after establishment.

1964 Experiments - We applied paraquat and 2-chloro-4-ethylamino-6-isopropylamino-s-triazine (atrizine) logarithmically at rates ranging from 2.0 to 0.25 lb/acre and dalapon ranging from 6.0 to 0.75 lb/acre on plots 8 x 100 ft on April 24, 1964. Herbicides were applied in water at 58 gpa and 30 psi. The surfactant X-77[2] at 0.1% v/v was used with all spray solutions.

Other treatments were disk harrowing, furrowing, and control. The disk harrowing was done with an offset disk harrow. Furrows, 4 to 6 inches deep and 4 inches across at the bottom and 10-12 inches at the top, were made with shovels attached to a toolbar.

We seeded two rows of intermediate wheatgrass (*Agropyron intermedium* (Host) Beauv.) and one row each of standard crested wheatgrass (*Agropyron desertorum* (Fishc.) Schult.) and Russian wildrye (*Elymus junceus* Fisch.) immediately after treatment except for the plots treated with dalapon and atrizine. Plots treated with dalapon were seeded two weeks later using the same species; plots treated with atrizine were left unseeded. The perennial grass seedlings failed to become established in any of the treatments. On November 24, 1964, all treatments that had been seeded in the spring of 1964 were reseeded with two rows of Amur

intermediate wheatgrass and one row each of standard crested wheatgrass and fairway crested wheatgrass (Agropyron cristatum (L.) Gaertn.). A dense stand of field bindweed developed in 1965 on all plots where medusahead was controlled. To reduce the field bindweed competition, we applied 1 lb/acre acid equivalent of propylene glycol butyl ether esters of 2,4-dichlorophenoxyacetic acid (2,4-D) on May 21 and July 3, 1965.

1965 Experiments - We disk harrowed a 50x100 ft block on May 5, 1965. The disk harrowing provided a summer fallow free of medusahead plants although we had to spray the area on May 24 and June 16 with 2 lb/acre of 2, 4-D to reduce the bindweed population. We seeded the fallow on October 1, 1965, with Amur intermediate wheatgrass.

1966 Experiments - We repeated the most successful 1964 treatments - disk harrowing, furrowing, and dalapon - in 1966. The very low precipitation during the winter of 1965-66 permitted earlier application of treatments in 1966 than in 1964. Using the same experimental design as the one employed in 1964, we seeded, disk-harrowed, and furrowed plots to Amur intermediate wheatgrass on March 15, 1966. Because of incomplete emergence of the medusahead population, the 3 lb/acre dalapon treatment was delayed until April 19. Plots treated with dalapon were seeded on May 3, 1966, to intermediate wheatgrass. The disk harrow and furrow treatments were repeated on April 19, a date comparable to the 1964 treatments. Field bindweed was again a serious problem. We sprayed all treatments with 1.5 lb/acre of 2, 4-D on May 4 and June 15, 1966. Perennial grass stands on both the March and April plots were unsatisfactory; we therefore reseeded all plots with Amur intermediate wheatgrass on October 11, 1966.

RESULTS

1964 Experiments - Paraquat caused considerable discoloration of medusahead leaves soon after application. After a few weeks the medusahead plants completely recovered and no weed control was obtained. Atrazine at rates ranging from 1 to 2 lb/acre controlled medusahead on the drier, upper slope portion of the plots. The treatments located on the moist lower slope required 2 lb/acre of actazine to control medusahead. Dalapon at rates ranging from 2 to 6 lb/acre resulted in excellent control. The disk harrowed and furrowed plots were essentially free of medusahead. All treatments that reduced medusahead were followed by a heavy infestation of field bindweed.

No seedlings of any perennial grass species survived after August 1. More seedlings of intermediate wheatgrass emerged and lived longer than the other three species tested. Also, more seedlings emerged and lived longer in the disked and furrowed treatments than in the dalapon treated

areas (Fig. 1). The dalapon treatment had the disadvantage of a two-week delay of seeding. Residual herbicidal activity of dalapon in the soil made this delay necessary (Holstun and Loomis, 1956).

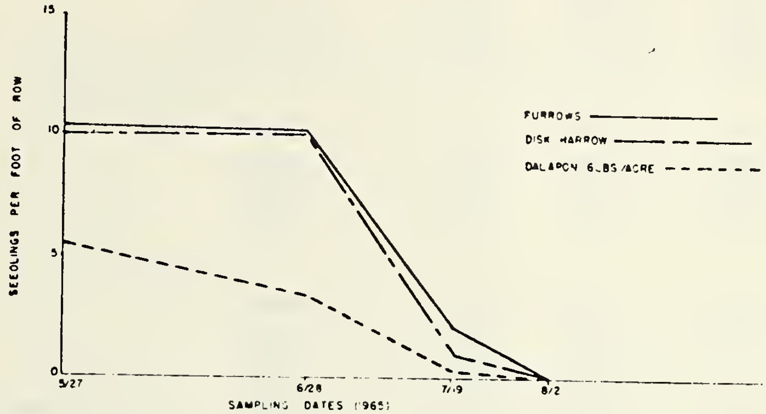

FIG. 1. Intermediate wheatgrass seedling survival in relation to weed control treatments. All treatments were applied and seeded in the spring of 1964.

Excellent intermediate wheatgrass stands were obtained on the plots seeded in the fall of 1964 that had been treated with dalapon, disk harrowed, or furrowed the previous spring (Table 1). Standard and fairway crested wheatgrass stands were considered failures on all treatments. Plots treated with atrazine had unsatisfactory wheatgrass stands, except at the 2 lb/acre rate which had a fair stand. Two lb/acre of atrazine and disk harrowing markedly reduced medusahead yield below the control population. The 0.5 lb/acre atrazine treatment increased medusahead production.

An important factor in the successful establishment of the wheatgrass seedlings was suppression of field bindweed with application of 2,4-D.

Plots that were disk harrowed or which had been sprayed with higher rates of dalapon in 1964 produced more intermediate wheatgrass and less medusahead in 1966 than the other 1964 treatments (Table 2). In 1967, the plots sprayed with 6 lb/acre of dalapon or disk harrowed in 1964 produced significantly more intermediate wheatgrass than the other treatments. The plots treated with atrazine in 1964 supported vigorous wheatgrass plants, but stands were too sparse for satisfactory yields. In the very wet season of 1967, medusahead growth was significantly suppressed by all treatments; but yield of medusahead in successful wheatgrass stands exceeded that of control plots in 1966. The most productive wheatgrass stands suppressed, but did not eliminate medusahead.

Table 1. Medusahead yield and wheatgrass seedlings per ft of row 1964 fall seeded treatments.[a]

Treatment	Medusahead Yield lb/A[b]	Wheatgrass seedlings/ft of row: Inter-mediate Whtg	Standard Crested Whtg	Fairway Crested Whtg
Dalapon (lb/A)				
6	280b	6.2	0.4	0.1
3	200bc	6.0	0.1	0.2
1.5	150c	6.0	0.0	0.0
0.75	270b	5.5	0.1	0.1
Atrazine (lb/A)				
2	120dc	1.2	0.1	0
1	230b	0.9	0.1	0.1
0.5	440a	0.2	0.0	0
Disk harrow	140c	6.2	0.7	0.1
Furrows	200bc	5.4	0.3	0.6
Control	280b	0.4	0.0	0.0

[a] Medusahead yield was taken the fallow year (1964) and seedling counts were made the seedling year (1965).

[b] Means followed by the same letter are not significantly different at 0.5 probability level as determined by Duncan's Range Test.

Table 2. Yield in lb/acre dry matter of medusahead and intermediate wheatgrass for two and three years after establishment of perennial grass seedlings.[a]

Treatment	Rate (lb/A)	1966 Inter-mediate Whtg	1966 Medusa-head	1967 Inter-mediate Whtg	1967 Medusa-head
Dalapon	6	940a	390c	1600a	770b
	3	860b	590b	1110b	750bc
	1.5	920ab	510bc	1100b	710c
	0.75	380d	460c	560c	830b
Atrazine	2	540c	740a	640c	760b
	1	360d	640a	460c	740bc
Disk-harrow		1100a	280d	1540a	770b
Furrows		600c	450c	980b	820b
Control		0e	650a	0d	1300a

[a] Weed control treatments applied in spring, 1964; intermediate wheatgrass seeded in fall, 1964.

[b] Means followed by the same letter are not significantly different at the 0.5 probability level as determined by Duncan's Range Test. All comparisons are made vertically.

A few scattered plants of standard and fairway crested wheatgrass were established in the dalapon, disk harrowed, and furrowed treatments, but stands were too sparse for yield measurements. The control plots were devoid of all wheatgrass plants by the 1966 sampling.

1965 Experiments - The 50 x 100 ft block that was summer fallowed by disk harrowing in 1965, and seeded in October 1965, produced an excellent stand of intermediate wheatgrass in 1966. More than five perennial grass seedlings/ft of row became established in spite of the extremely dry spring and summer of 1966. Because the block was used for other experiments, second year wheatgrass yields were not taken.

1966 Experiments - Plots furrowed and those disk harrowed in March 1966 produced marginal stands of intermediate wheatgrass seedlings in 1966 (Table 3). Treatments applied in April 1966 were complete failures. When intermediate wheatgrass was reseeded in October 1966, plots treated in March produced more seedlings than those treated late in April.

DISCUSSION

Intermediate wheatgrass seedlings were successfully established in a medusahead community in 1965, 1966, and 1967 with mechanical or chemical fallow treatments. With the exception of the 1965 summer fallow by disk harrowing, treatments were not exclusively designed to create a fallow. However, the summer fallow option was always much more successful than spring seeding, and summer fallowing by disk harrowing was the most successful treatment. The advantages of summer fallowing for seeding perennial wheatgrass on downy brome infested rangelands have been demonstrated by Eckert and Evans (1967).

Table 3. Intermediate wheatgrass seedlings per ft of row 1966 treatments (All seedings made in 1966).

Treatment	Seeded March	Reseeded October	Seeded April	Reseeded October
Furrowed	1.8	9.0	0	4.3
Disk-harrow	1.1	7.0	0	6.2
Dalapon, 3 lb/A	0[b]	2.0	0[b]	1.9
Control	0	0.4	0	0

[a]Seedling counts made in late July 1966 and 1967.
[b]Seeded two weeks later than other treatments to avoid residual soil activity of herbicide.

During years of average or above average precipitation, the Verdi site is too wet and muddy to permit weed control and seeding treatments until late in the spring. This severely limits the chances of success with spring seeding. During the very dry spring of 1966, it was possible to apply treatments and seed in March, but resulting wheatgrass stands were marginal. Using similar weed control techniques on sites in Nevada where early spring treatment is possible, Evans et al., (1967) have been successful in establishing wheatgrass in downy brome communities with spring seedings.

Any reduction in medusahead density at Verdi resulted in an increase in field bindweed. The suppression of the field bindweed by spraying 2,4-D during the summer fallow and the seedling years aided establishment of wheatgrass seedlings. Torell (1967) reported similar problems with other broadleaf species in Idaho.

Downy brome did not significantly increase on plots treated with dalapon at Verdi. This species has significantly increased on other medusahead sites and caused severe competition to wheatgrass seedling following dalapon fallow treatments (Torell, 1967).

The disk harrowing, furrowing, and higher rates of dalapon treatments virtually eliminated the medusahead population for one year. Even though wheatgrass seedlings completely stocked plots so treated, medusahead reinvaded the plots during the seedling year. Wheatgrass stands, after the seedling year, suppressed growth of medusahead, but certainly did not eliminate it. Turner, et al., (1963) advocated weed control treatments to remove medusahead from established stands of wheatgrass.

On the Verdi medusahead site, Amur intermediate wheatgrass was superior to standard or fairway crested wheatgrass in seedling stand establishment.

The site at Verdi is representative of the margins of wet meadows in degraded condition found in the Great Basin. Medusahead is evidently well adapted to these environmental conditions. The discontinuous distribution of meadows in the Great Basin should hinder the spread of medusahead. However, no matter how remote and disjunct these meadowsites may be, competitive species such as Baltic rush are omnipresent. Given time, medusahead may become widely distributed on these restricted sites.

The generally steep and rocky terrain of much medusahead infested rangeland imposes limitations on the feasibility of applying the tillage methods developed at Verdi to all medusahead infestations. The acreage

of rangelands infested with medusahead where these tillage methods may be applied is small in comparison to the total acreage infested by the species, but the tillable sites are usually the most productive and offer the greatest return of investment. If weed control necessary to establish wheatgrass seedlings could be accomplished by a chemical fallow, thousands of acres ordinarily tilled only with difficulty, could be seeded with a heavy rangeland drill.

CONCLUSIONS

Intermediate wheatgrass seedlings were successfully established in a medusahead community in 1965, 1966, and 1967 with mechanical or chemical fallow treatments. Summer fallowing with a disk harrow was the most successful treatment. However, chemical fallowing with dalapon offers the possiblity of extending the technique to areas not suitable for tillage.

The fallow treatments were much more successful for wheatgrass establishment than spring seeding following tillage or herbicide treatments.

Any reduction in medusahead density resulted in an increase in field bindweed. The suppression of field bindweed by spraying 2, 4-D during the summer fallow and seedling years aided establishment of wheatgrass seedlings.

Intermediate wheatgrass produced the best stands among all grasses seeded regardless of weed control method. Established stands of intermediate wheatgrass greatly suppressed but did not eliminate medusahead.

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A good SAFETY RECORD is NO ACCIDENT.